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EXAMINER	
LAVIN, CHRISTOPHER L	
ART UNIT	**PAPER NUMBER**
2621	

DATE MAILED: 02/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/936,998	BRADY ET AL.	
	Examiner	Art Unit	
	Christopher L Lavin	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 September 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-43* is/are pending in the application.

4a) Of the above claim(s) *1-23* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *24-43* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 37 and 39 are objected to because of the following informalities: The claims reference claim 13, which should be claim 36. Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 29 – 32, and 35 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. In regards to claim 29 it is not clear which "stored probabilities" are to be multiplied. It would appear that this phrase is suggesting all of the neighboring probabilities, but that is not what the applicant described in the specification in fact claim 7 clarifies that only one probability (the maxima) per sampling point is used at each time.

5. Claims 30 – 32 are rejected under 35 U.S.C. 112 as they depend from claim 29.

6. In regards to claim 35 it is not clear how the number of iterations could and actually does depend on "the distance between salient points in the image".

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

> the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 24 – 30, 35 – 39, 42, and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cham ("A Statistical Framework for Long-Range Feature Matching in Uncalibrated Image Mosaicing", 1998) in view of Martens (6,157,677).

11. In regards to claim 42, Apparatus for processing image data of a plurality of time-separated images of a non-rigid body to detect movement of the body, comprising: calculating means for calculating for each of a plurality of sampling points in each image a plurality of candidate movements together with the estimated probability, i.e.,

similarity, of each candidate (Page 4, the second to last paragraph in the first column); storage means for storing said candidate movements and estimated probabilities (A storage means of some sort inherently must exist for the apparatus disclosed by Cham to work); recalculating means for iteratively recalculating for each sampling point the probability of each of the candidate movement based on the stored probability of that candidate movement and the probabilities of the candidate movements at other sampling points (Page 2, second paragraph under 2.1: Cham is describing an iterative process by steadily increasing resolutions to refine the probabilities); and motion field generating means for generating from the recalculated probabilities a motion field indicative of the [non-rigid body movement] (Page 1, first paragraph of the introduction: Motion estimation using motion fields is used to create an image mosaic.).

Cham teaches of using motion estimation using similarity measurements and Bayesian equations to create a mosaiced image, however Cham does not teach to use this technique for estimating motion between non-rigid bodies.

Martens teaches in col. 14, lines 61 – 65; col. 15, lines 17 – 24; and col. 14, lines 22 – 25 that a motion field can be created using an iterative process of finding similarity measurements which can be used to find movement between bodies. Marten further teaches in col. 4, line 60 that this technique can be used for 3D structures such as MRI scans of a human brain. MRI scans will result in images of non-rigid bodies. Thus Martens teaches of determining movement between non-rigid bodies using motion fields and similarity.

Therefore it would be obvious to one having ordinary skill in the art at the time of the invention to use the motion estimation as disclosed by Cham to track movement on non-rigid bodies as taught by Martens. Cham on the first page, fifth paragraph on the second column states that when image motion is large the approach taken by Cham will provide a better match, as non-rigid body implies large scale motion the method disclosed by Cham would be ideal for tracking this motion.

12. In regards to claim 24, claim 24 is rejected for the same reason as claim 42, except that claim 24 is a method claim. The argument analogous to that presented above for claim 42 is applicable to claim 24.

13. In regards to claim 25, A method according to claim 24, wherein the other sampling points are the neighboring sampling points (Page 3, first paragraph under section 2.3.1: Cham finds similarity between features, which are groups of sampling points in a neighborhood).

14. In regards to claim 26, A method according to claim 24, wherein the sampling points correspond to unit areas containing a set of pixels of the image (Inherently the features disclosed by Cham would include areas consisting of pixels as every digital image is comprised of pixels).

15. In regards to claim 27, A method according to claim 24, wherein the plurality of candidate movements and their probabilities are calculated by calculating a similarity measure indicating the similarity of each sampling point to sampling points in the preceding image, and normalizing the similarity measures to sum to unity, the normalized similarity measure being stored as said probabilities, and the candidate

movements are the corresponding vector displacements which map the sampling point to the respective sampling points in the preceding image (Page 2, first paragraph titled Robust Regression; Page 4, second to last paragraph first column; Page 3, first paragraph under section 2.2; Page 4, first paragraph under section 2.3.1: Cham teaches that similarity measurements are incorporated into the standard Bayesian approach which includes a normalization factor. Thus the similarity measurement will be normalized. A motion field is designed to map the vector displacements to the respective sampling points in the preceding image.).

16. In regards to claim 28, A method according to claim 27 wherein the similarity measure is selected from mutual information, normalized mutual information, entropy correlation coefficient and centered cross correlation (Page 2, second paragraph titled Incorporating Similiarity Measures in Regression: cross-correlation is used to find similarity measurements).

17. In regards to claim 29, A method according to claim 24, wherein the iterative recalculation of the stored probabilities comprises multiplying each stored probability by the product of the stored probabilities of the neighboring sampling points (Page 3, first paragraph under section 2.3.1: This claim is describing the Bayesian approach which is what the equations in the paragraph listed above are describing.).

18. In regards to claim 30, A method according to claim 29, wherein the iterative recalculation of the stored probabilities comprises multiplying each stored probability by the product of the respective maxima of the stored probabilities for the neighboring sampling points (Page 2, second paragraph under section 2.1; Each hypothesis

described in this paragraph is the maxima from that iteration. The rest of this claim consists of a Bayesian approach, which has already been show).

19. In regards to claim 35, A method according to claim 24, wherein the number of iterations is set according to the distance between salient points in the image (As previously shown this claim is unclear. Cham, page 2, second paragraph under section 2.1 teaches that iterations depend on the number of resolution levels).

20. In regards to claim 36, A method according to claim 24, wherein the motion field is generated by selecting as the movement at each sampling point the candidate movement having the maximum probability after said iterative recalculation (As it has already been shown the maximum is found for each sampling point and is used as the probability for that point. Also the iterative step has already been shown.).

21. In regards to claim 37, A method according to claim 36, further comprising the step of correcting the plurality of images for the movement by applying thereto a transformation based on the motion field, and then repeating the method of claim 36 using differently spaced sampling points to generate a new motion field (Page 5, first full paragraph in first column; page 2, second paragraph under section 2.1: When the resolution is increased the sampling points will be differently spaced. The remainder of this claim has already been addressed).

22. In regards to claim 38, A method according to claim 37, wherein the transformation is calculated by fitting a parametric transformation to the motion field (Page 5, first full paragraph in first column).

23. In regards to claim 39, A method according to claim 37, wherein the steps of correcting the plurality of images for the movement and then repeating the method of claim 36 using differently spaced sampling points, are carried out iteratively with successively more closely spaced sampling points (Page 5, first full paragraph in first column; page 2, second paragraph under section 2.1: When the resolution is increased the sampling points will be differently spaced. The remainder of this claim has already been addressed).

24. In regards to claim 43, claim 43 is rejected for the same reasons as claim 42. The argument similar to that presented above for claim 42 is applicable to claim 43. Claim 43 distinguishes from claim 42 only in that it recites a "computer program". However Cham teaches (Page 5, first paragraph under section 3) that a Sun UltraSparc 1 workstation is used to perform the operations described above. A computer program is inherently needed to perform these operations on the workstation.

25. Claims 33 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cham (as modified by Martens) in view of Lu (EP 0 652 536 A2).

26. In regards to claim 33, as previously shown Cham (as modified by Martens) discloses a method with iterative recalculation of the probabilities of motion. However Cham does not teach of using only movements at neighboring sampling points, which are judged to be similar to the said movements at each sampling point. This is very well known in the art as taught by Lu.

Lu teaches in page 4, lines 26 – 29 that outliers (vectors that are not similar) are rejected.

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to only use similar vectors as taught by Lu when calculating similarity measurements in the method disclosed by Cham (as modified by Martens). By rejecting outliers a more accurate maxima can be found resulting in a better motion field.

27. In regards to claim 34, A method according to claim 33, wherein movements are judged to be similar if the difference in magnitudes of the displacements caused by the movements is less than a preset amount (Lu, page 6, lines 6 – 10).

28. Claims 40 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cham (as modified by Martens) in view of Harms (5,214,382)

29. In regards to claims 40 and 41, Cham (as modified by Martens) discloses a method for motion estimation on non-rigid bodies. As has previously been shown by Cham non-rigid bodies can include magnetic resonance images. Cham however does not disclose taking images of a human breast or using a contrast agent.

Harms teaches in col. 13, lines 18 – 26 that an image of a breast can be obtained through a MRI device using a contrast agent.

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to use the non-rigid motion estimation method disclosed by Cham (as modified by Martens) for imaging a human breast using contrast agents in an MRI device. Time-separated images of breasts (using contrast agents to highlight areas of interest) are often used to diagnose cancer, the method disclosed by Cham would be an ideal way to follow the changes in a time-varying series of breast images.

Allowable Subject Matter

30. Claims 31 and 32 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

31. The following is a statement of reasons for the indication of allowable subject matter:

32. In regards to claims 31 and 32, the art of record does not teach nor does it suggest the specific features called for in the claims, particularly having the maxima weighted according to the difference between said candidate movmenets and the respective stored movements corresponding to the maxima along with the other claimed features.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher L Lavin whose telephone number is 703-306-4220. The examiner can normally be reached on M - F (8:30 - 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Boudreau can be reached on (703) 305-4706. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CLL

DANIEL MIRIAM
PRIMARY EXAMINER